MULTIMEDIA UNIVERSITY*

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 2, 2022/2023**

## BQA1014 – QUANTITATIVE ANALYSIS MODELS FOR BUSINESS

(All sections/Groups)

4 JULY 2023
9.00 a.m – 11.00 a.m
(2 Hours)

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## INSTRUCTIONS TO STUDENT

1. This question paper consists of 8 pages with 4 questions only.
2. Attempt **all FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. Formulae are attached at the end of the question paper.
5. Students are allowed to use scientific calculators (without restriction).

## Question 1

a) Many complaints have been received in the past six months regarding airlines losing fliers' baggage. The airlines claim the problem is nowhere near as great as the newspaper articles have indicated. In fact, one airline spokesman claimed that less than 1% of all bags fail to arrive at the destination with the passenger. To test this claim, 800 bags were randomly selected at various airports in the United States when they were checked with this airline, and of these 6 failed to reach the destination when the passenger arrived. Is there sufficient evidence to support the airline spokesman's claim? Test at 0.05 level of significance. (12 marks)

b) Various types of retail outlets sell gifts and souvenirs during the festive season. Among them are specialty gift shops, large discount gift shops, and other retailers that carry gift items as only one part of their stock of goods. Is there any difference in the sales amount of a customer purchase between large discount gift shops and specialty gift shops if they carry relatively comparable types of gift items? Suppose that last month 60 sales slips were randomly selected from a large discount gift shop and a specialty gift shop, respectively. The data is summarised in the following table:

| Large Discount Gift Shop | Specialty Gift Shop |
|---|---|
| $\overline{X}_1 = RM117.20$<br>$s_1 = RM12.45$ | $\overline{X}_2 = RM86.40$<br>$s_2 = RM9.75$ |

Use $\alpha = 0.01$ and the data to determine whether there is a significant difference in the average size of purchases at these stores. (13 marks)

(Total: 25 marks)

**Continued...**

**Question 2**

a) The outbreak of COVID-19 has sparked online businesses. In accordance with this phenomenon, the demand for delivery services has also been on the rise. The delivery service business has become very competitive. The well-maintained service quality by the delivery providers will increase their market share. Hence, a marketing manager from a delivery service provider intends to study customer satisfaction with delivery services towards the e-commerce during COVID-19. The collected data from the survey was analysed and presented in the following table.

| Source of Variation | *SS* | *df* | *MS* | *F* |
|---|---|---|---|---|
| Regression | *** | *** | *** | *** |
| Residual | 23.110 | *** | *** | |
| Total | 79.422 | 199 | | |

| Variable | *t Stat* |
|---|---|
| Reliability | 2.985 |
| Responsiveness | 1.594 |
| Assurance | 3.069 |
| Empathy | 2.911 |

(i) Complete the ANOVA table. (5 marks)

(ii) Compute the coefficient of multiple determination and explain. (3 marks)

(iii) Test the regression coefficients individually. Would you consider omitting any variables? If so, which one? Use 5% significance level. (6 marks)

b) Research was conducted on the service quality provided by three different retail shops that sell identical products. The grade of the service quality of each retail shops are presented as in the following table.

| Retail shop | Service Quality | | | |
|---|---|---|---|---|
| | Poor | Acceptable | Good | Excellent |
| A | 32 | 40 | 35 | 15 |
| B | 68 | 100 | 45 | 23 |
| C | 55 | 60 | 30 | 17 |

Test whether the quality grade and the retail shops are related at 5% significance level. (11 marks)

(Total: 25 marks)

**Continued...**

## Question 3

Bites & Treats, a beloved Malaysian bakery, faces fierce competition from other local bakeries. To stay ahead of the game, they produce the most popular cakes that customers love - chocolate cake and cheesecake. However, with limited resources of 240 labour hours and 345 cups of flour per week, they want to strategise to maximise their profits. A chocolate cake requires 3 hours of labour and 6 cups of flour, while a cheesecake takes 3 hours of labour and 3 cups of flour. Bites & Treats can sell a maximum of 60 chocolate cakes and 90 cheesecakes each week, earning RM15 and RM20 in profit respectively. But that's not all - the bakery has also received a large order from a corporate client who wants at least 20 chocolate cakes and 25 cheesecakes per week.

a) Formulate the above problem as a Linear Programming problem. (6 marks)

b) Graph and show the feasible region of the above problem clearly. (7 marks)

c) Find the optimal solution and the associated maximum total profit. (9 marks)

d) What would be the effect on the optimal solution if the profit of the chocolate cake had increased from RM 15 to RM 22? (3 marks)

(Total: 25 marks)

**Continued...**

## Question 4

a) A furniture company sells a set of dining tables at a price of RM10,888 per set. The total variable cost for a set of dining tables is 6743Q where Q is the monthly quantity produced and sold by the company. The monthly fixed cost supported by the company is RM683,925.

(i) Formulate the cost function, revenue function and profit function based on the above given information. (3 marks)

(ii) What is the new selling price of the dining table set if the company wishes to obtain a profit of RM250,000 by selling 180 units of tablets per month? (3 marks)

b) The sales record (in thousands of RM) of a company for the past three years are recorded as table below:

| Year | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|---|---|---|---|---|
| 2020 | 102 | 109 | 120 | 94 |
| 2021 | 104 | 119 | 126 | 105 |
| 2022 | 111 | 127 | 137 | 117 |

(i) Find the trend by means of a moving average and the average seasonal components using an additive model. (14 marks)

(ii) Forecast the sales for the first two quarters of the year 2023. (5 marks)

(Total: 25 marks)

**End of Paper**

# APPENDIXES:
# I. STATISTICAL FORMULAE

## A. DESCRIPTIVE STATISTICS

**Ungrouped Data:**

Sample Mean, $\bar{x} = \frac{\sum x}{n}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum x^2}{n-1} - \frac{(\sum x)^2}{n(n-1)}}$

**Grouped Data:**

Sample Mean, $\bar{x} = \frac{\sum fx}{\sum f}$ Sample Standard Deviation,

$s = \sqrt{\frac{\sum fx^2}{\sum f - 1} - \frac{(\sum fx)^2}{\sum f(\sum f - 1)}}$

Median $= L_m + \left[\frac{\left(\frac{\sum f}{2} - F_{m-1}\right)}{f_m}\right]c$ Mode $= L_m + \left[\frac{(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}}\right]c$

## B. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

(100 - α)% Confidence Interval for Population Mean,(σ Known) is $\mu = \bar{x} \pm Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

(100 - α)% Confidence Interval for Population Mean (σ Unknown) is $\mu = \bar{x} \pm t_{\alpha/2, n-1} \frac{s}{\sqrt{n}}$

(100 - α)% Confidence Interval for Population Proportion is $\pi = p \pm Z_{\alpha/2}\sqrt{\frac{p(1-p)}{n}}$

Sample Size Determination for Population Mean = $n = \left(\frac{Z_{\alpha/2}\sigma}{e}\right)^2$

Sample Size Determination for Population Proportion = $n = \frac{(Z_{\alpha/2})^2 \pi(1-\pi)}{e^2}$

Where e = Limit of Error in Estimation

## C. HYPOTHESIS TESTING

**One Sample Mean Test**

***Z*-test:** $Z = \dfrac{\bar{x} - \mu}{\dfrac{\sigma}{\sqrt{n}}}$ ***t*-test:** $t = \dfrac{\bar{x} - \mu}{\dfrac{s}{\sqrt{n}}}$

**One Sample Proportion Test**

$$Z = \frac{p - \pi}{\sqrt{\dfrac{\pi(1-\pi)}{n}}}$$

***Two Sample Mean Test***

***Z*-test:** $Z = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$

***t*-test:** $t = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$ where $s_p = \sqrt{\dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$

**Two Sample Proportion Test**

$$Z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left[\dfrac{1}{n_1} + \dfrac{1}{n_2}\right]}}$$ where = $\bar{p} = \dfrac{x_1 + x_2}{n_1 + n_2}$

## D. ANALYSIS OF VARIANCE

$$SST = \sum_{i=1}^{k}\sum_{j=1}^{n_j}\left(X_{ij} - \bar{\bar{X}}\right)^2 \qquad SSB = \sum_{i=1}^{k} n_i\left(\bar{X}_i - \bar{\bar{X}}\right)^2$$

$$SSW = \sum_{i=1}^{k}(n_i - 1)s_i^2 \quad \text{or} \quad SSW = \sum_{i=1}^{k}\sum_{j=1}^{n_j}(x_{ij} - \bar{x}_i)^2$$

## E. CHI-SQUARE ANALYSIS

**Expected cell frequencies for Independent Test:**

$$E_i = \frac{Row\ total \times Column\ total}{N}$$

**Chi-Square test statistic:** $\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$

$O_i$ = Observed frequency in a particular cell

$E_i$ = expected frequency in a particular cell

## F. REGRESSION ANALYSIS

**Correlation Coefficient:** $r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$

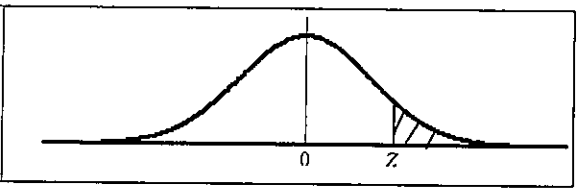
**Simple Linear Regression:** $Y = a + bX$ where $b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$ and

$a = \bar{y} - b\bar{x}$

# II. STATISTICAL TABLE

**Table 1**

The Upper Tail Area Under the Standard Normal Curve




| Z | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|---|---|---|---|---|---|---|---|---|---|---|
| **0.0** | 0.5000 | 0.4960 | 0.4920 | 0.4880 | 0.4840 | 0.4801 | 0.4761 | 0.4721 | 0.4681 | 0.4641 |
| **0.1** | 0.4602 | 0.4562 | 0.4522 | 0.4483 | 0.4443 | 0.4404 | 0.4364 | 0.4325 | 0.4286 | 0.4247 |
| **0.2** | 0.4207 | 0.4168 | 0.4129 | 0.4090 | 0.4052 | 0.4013 | 0.3974 | 0.3936 | 0.3897 | 0.3859 |
| **0.3** | 0.3821 | 0.3783 | 0.3745 | 0.3707 | 0.3669 | 0.3632 | 0.3594 | 0.3557 | 0.3520 | 0.3483 |
| **0.4** | 0.3446 | 0.3409 | 0.3372 | 0.3336 | 0.3300 | 0.3264 | 0.3228 | 0.3192 | 0.3156 | 0.3121 |
| **0.5** | 0.3085 | 0.3050 | 0.3015 | 0.2981 | 0.2946 | 0.2912 | 0.2877 | 0.2843 | 0.2810 | 0.2776 |
| **0.6** | 0.2743 | 0.2709 | 0.2676 | 0.2643 | 0.2611 | 0.2578 | 0.2546 | 0.2514 | 0.2483 | 0.2451 |
| **0.7** | 0.2420 | 0.2389 | 0.2358 | 0.2327 | 0.2296 | 0.2266 | 0.2236 | 0.2206 | 0.2177 | 0.2148 |
| **0.8** | 0.2119 | 0.2090 | 0.2061 | 0.2033 | 0.2005 | 0.1977 | 0.1949 | 0.1922 | 0.1894 | 0.1867 |
| **0.9** | 0.1841 | 0.1814 | 0.1788 | 0.1762 | 0.1736 | 0.1711 | 0.1685 | 0.1660 | 0.1635 | 0.1611 |
| **1.0** | 0.1587 | 0.1562 | 0.1539 | 0.1515 | 0.1492 | 0.1469 | 0.1446 | 0.1423 | 0.1401 | 0.1379 |
| **1.1** | 0.1357 | 0.1335 | 0.1314 | 0.1292 | 0.1271 | 0.1251 | 0.1230 | 0.1210 | 0.1190 | 0.1170 |
| **1.2** | 0.1151 | 0.1131 | 0.1112 | 0.1093 | 0.1075 | 0.1056 | 0.1038 | 0.1020 | 0.1003 | 0.0985 |
| **1.3** | 0.0968 | 0.0951 | 0.0934 | 0.0918 | 0.0901 | 0.0885 | 0.0869 | 0.0853 | 0.0838 | 0.0823 |
| **1.4** | 0.0808 | 0.0793 | 0.0778 | 0.0764 | 0.0749 | 0.0735 | 0.0721 | 0.0708 | 0.0694 | 0.0681 |
| **1.5** | 0.0668 | 0.0655 | 0.0643 | 0.0630 | 0.0618 | 0.0606 | 0.0594 | 0.0582 | 0.0571 | 0.0559 |
| **1.6** | 0.0548 | 0.0537 | 0.0526 | 0.0516 | 0.0505 | 0.0495 | 0.0485 | 0.0475 | 0.0465 | 0.0455 |
| **1.7** | 0.0446 | 0.0436 | 0.0427 | 0.0418 | 0.0409 | 0.0401 | 0.0392 | 0.0384 | 0.0375 | 0.0367 |
| **1.8** | 0.0359 | 0.0351 | 0.0344 | 0.0336 | 0.0329 | 0.0322 | 0.0314 | 0.0307 | 0.0301 | 0.0294 |
| **1.9** | 0.0287 | 0.0281 | 0.0274 | 0.0268 | 0.0262 | 0.0256 | 0.0250 | 0.0244 | 0.0239 | 0.0233 |
| **2.0** | 0.0228 | 0.0222 | 0.0217 | 0.0212 | 0.0207 | 0.0202 | 0.0197 | 0.0192 | 0.0188 | 0.0183 |
| **2.1** | 0.0179 | 0.0174 | 0.0170 | 0.0166 | 0.0162 | 0.0158 | 0.0154 | 0.0150 | 0.0146 | 0.0143 |
| **2.2** | 0.0139 | 0.0136 | 0.0132 | 0.0129 | 0.0125 | 0.0122 | 0.0119 | 0.0116 | 0.0113 | 0.0110 |
| **2.3** | 0.0107 | 0.0104 | 0.0102 | 0.0099 | 0.0096 | 0.0094 | 0.0091 | 0.0089 | 0.0087 | 0.0084 |
| **2.4** | 0.0082 | 0.0080 | 0.0078 | 0.0075 | 0.0073 | 0.0071 | 0.0069 | 0.0068 | 0.0066 | 0.0064 |
| **2.5** | 0.0062 | 0.0060 | 0.0059 | 0.0057 | 0.0055 | 0.0054 | 0.0052 | 0.0051 | 0.0049 | 0.0048 |
| **2.6** | 0.0047 | 0.0045 | 0.0044 | 0.0043 | 0.0041 | 0.0040 | 0.0039 | 0.0038 | 0.0037 | 0.0036 |
| **2.7** | 0.0035 | 0.0034 | 0.0033 | 0.0032 | 0.0031 | 0.0030 | 0.0029 | 0.0028 | 0.0027 | 0.0026 |
| **2.8** | 0.0026 | 0.0025 | 0.0024 | 0.0023 | 0.0023 | 0.0022 | 0.0021 | 0.0021 | 0.0020 | 0.0019 |
| **2.9** | 0.0019 | 0.0018 | 0.0018 | 0.0017 | 0.0016 | 0.0016 | 0.0015 | 0.0015 | 0.0014 | 0.0014 |
| **3.0** | 0.0013 | 0.0013 | 0.0013 | 0.0012 | 0.0012 | 0.0011 | 0.0011 | 0.0011 | 0.0010 | 0.0010 |
| **3.1** | 0.0010 | 0.0009 | 0.0009 | 0.0009 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0007 | 0.0007 |
| **3.2** | 0.0007 | 0.0007 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0005 | 0.0005 | 0.0005 |
| **3.3** | 0.0005 | 0.0005 | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0003 |
| **3.4** | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0002 |
| **3.5** | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 |
| **3.6** | 0.0002 | 0.0002 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| **3.7** | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| **3.8** | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| **3.9** | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **4.0** | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |